

## 模糊推論系統於花蓮地區土石流危險評估之探討

林保宏<sup>[1]</sup> 陳昆揮<sup>[2]</sup> 盧炳志<sup>[3]</sup> 林國峰<sup>[4]</sup>

**摘 要** 一般研究均顯示影響土石流發生的主要因素可能包括有地形平均坡度、降雨量、集水面積、降雨強度、地質狀況等。由於各影響因素間之交互關聯效果難以明確界定，其中實則包含一定程度的模糊關聯性，因之，本文主要以蒐集花蓮地區土石流案例為基礎，建立一模糊推論系統，以評估土石流發生之可能性。系統中除了考量包含影響土石流之因素以及利用模糊數來表示各項影響因素外，由於顧及實際案例全面性或有可能不足，故本研究亦同時擷取相關文獻中的專家知識與研究意見，彙整建立成以案例為主體之土石流模糊推論系統。以本研究所建立之推論系統分析歷史案例與假設案例，其驗證與推論結果皆能滿足與符合各案例特性之結果預期；而由模糊數之效果更可充分反映出各影響條件之敏感性。本研究之初步成果顯示，模糊推論系統對於土石流發生危險性之推斷，具有可接受的理論依據與實際之參考價值。

**關鍵詞**：土石流、模糊理論、模糊推論。

## Using Fuzzy Inference System to the Prediction of Debris Flow Inducement in Hualien

Pao-Hung Lin<sup>[1]</sup> Kun-Hui Chen<sup>[2]</sup> Ping-Chih Lu<sup>[3]</sup> Gwo-Fong Lin<sup>[4]</sup>

**ABSTRACT** According to relevant studies, the factors inducing debris flow could include average slope of geography, precipitation, watershed area, rainfall intensity, geology, and so on. It is believed that among the factors indeed exist mutual correlations and involve a certain kind of fuzziness. Based on the past real cases of debris flow occurring in Hualien, this study proposes a fuzzy inference system to evaluate the possibility of debris flow inducement. The fuzzy theory will be employed to represent the influential factors, which are difficult to precisely define. Furthermore, considering probably insufficient real cases for inference base, the domain expert knowledge and relevant study results and suggestions are gathered to supplement the knowledge base to the present inference system. The proposed fuzzy inference system has been verified through specific real cases and implemented to show its expected performance in evaluating the possibility of debris flow inducement in a virtual scenario.

**Key Words:** debris flow, fuzzy theory, fuzzy inference.

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[1] 逢甲大學土木工程學系助理教授（通訊作者）

Assistant Professor, Department of Civil Engineering, Feng Chia University, Taichung 407, Taiwan, R.O.C.

(Corresponding Author)

E-mail: paolin@fcu.edu.tw

[2] 逢甲大學土木工程學系碩士班研究生

Graduate Student, Department of Civil Engineering, Feng Chia University, Taichung 407, Taiwan, R.O.C.

[3] 致遠管理學院營建管理學系助理教授

Assistant Professor, Department of Construction Management, Diwan College of Management, Tainan 721, Taiwan, R.O.C.

[4] 國立台灣大學土木工程學系教授

Professor, Department of Civil Engineering, National Taiwan University, Taipei 106, Taiwan, R.O.C.